

WHAT IS CLAIMED IS:

1. A composite box structure mounted on a railway car underframe comprising:
  - a floor assembly mounted on and attached to the railway car underframe;
  - a pair of side wall assemblies and a pair of end wall assemblies attached to the floor assembly and the railway car underframe;
  - each side wall assembly and each end wall assembly having an exterior surface formed from a plurality of metal sheets;
  - foam insulation bonded with interior surfaces of the metal sheets;
  - a temperature control unit mounted on one of the end wall assemblies;
  - a roof assembly attached to and coupled with the side wall assemblies and the end wall assemblies opposite from the floor assembly;
  - an air plenum assembly attached to and extending from an interior surface of the roof assembly;
  - an interior bulkhead disposed adjacent to and spaced from the one end wall assembly to provide portions of an airflow path to return air from an interior of the composite box structure to the temperature control unit;
  - and
  - a first end of the air plenum assembly coupled with a portion of the interior bulkhead to provide portions of an airflow path to supply air from the temperature control unit to the interior of the composite box structure.

2. The composite box structure of Claim 1 wherein the air plenum assembly further comprises:

a plurality of plenum panels disposed adjacent to each other and respectively attached with the roof assembly; and

a chute assembly forming a portion of the air supply flow path from the temperature control unit to the air plenum assembly.

10 3. The composite box structure of Claim 2 wherein the chute assembly further comprises:

a first support disposed on and attached with an upper portion of the interior bulkhead;

a transition panel attached with the first support and extending at an angle between the upper portion of the interior bulkhead and the air panel assembly; and

a first side panel and a second side panel respectively attached to opposite edges of the transition panel to direct airflow from the temperature control unit to the air plenum assembly.

4. The composite box structure of Claim 2 further comprising a respective hanger assembly disposed between each plenum panel and the roof assembly.

5. The composite box structure of Claim 1 wherein the floor assembly further comprises a primary floor and a secondary floor with an airflow path formed between the secondary floor and the primary floor to provide portions  
5 of an airflow path for supplying air to the interior of the composite box structure.

6. The composite box structure of Claim 1 further comprising;  
10 each side wall assembly having an interior surface defined in part by a plurality of fiber reinforced plastic layers; and  
the fiber reinforced plastic layers having a generally corrugated cross section which provide portions  
15 of airflow paths for supplying air to the interior of the composite box structure.

7. The composite box structure of Claim 1 further comprising an airflow coupling extending between a second  
20 end of the air plenum assembly and at least one airflow path disposed on an interior surface of the other end wall assembly.

8. The composite box structure of Claim 1 wherein  
25 the air plenum assembly further comprises:  
a plurality plenum panels; and  
openings formed in the plenum panels to allow controlled airflow from the air plenum assembly to the interior of the composite box structure.

9. A roof assembly for a railway car comprising:  
the roof assembly having a generally elongated,  
rectangular configuration;  
5 an air plenum assembly attached to and  
extending from an interior surface of the roof assembly;  
the air plenum assembly operable to receive air  
from a temperature control unit and to provide portions  
of an airflow path from the temperature control unit;  
10 the air plenum assembly formed in part by a  
plurality of plenum panels disposed adjacent to each  
other; and  
respective hanger assemblies attaching the  
plenum panels with the roof assembly.  
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10. The roof assembly of Claim 9 further comprising  
a seal formed between adjacent plenum panels.
11. The roof assembly of Claim 9 further comprising  
20 the hanger assemblies spaced from each other and  
extending along a longitudinal centerline of the roof  
assembly.

12. The roof assembly of Claim 9 further comprising:

- a first longitudinal edge and a second longitudinal edge spaced from each other and extending  
5 from a first lateral edge to a second lateral edge;
  - at least a first layer of fiber reinforced plastic and at least a second layer of fiber reinforced plastic with insulating foam disposed therebetween;
  - the longitudinal edges and the lateral edges of  
10 the roof assembly formed in part by bonding respective portions of the first layer of fiber reinforced plastic with the second layer of fiber reinforced plastic;
  - a plurality of stiffeners disposed between the first layer of fiber reinforced plastic and the second  
15 layer of fiber reinforced plastic; and
  - the stiffeners spaced from each other and extending from the first longitudinal edge to the second longitudinal edge.

13. A roof assembly for a temperature controlled railway car having a composite box structure mounted on a railway car underframe comprising:

5           the roof assembly having a generally elongated, rectangular configuration corresponding approximately with configurations of the composite box structure and the railway car underframe;

          the roof assembly having a generally arcuate  
10 configuration extending from a first longitudinal edge of the roof assembly to a second longitudinal edge of the roof assembly;

          the roof assembly having a cross section defined in part by a first layer of fiber reinforced  
15 plastic and a second layer of fiber reinforced plastic;

          the first layer and second layer cooperating with each other to encapsulate insulating material therebetween;

          the first longitudinal edge and the second  
20 longitudinal edge of the roof assembly formed in part from at least the two layers of fiber reinforce plastic;

          a plurality of trim moldings attached to and extending between the roof assembly and adjacent interior portions of the composite box structure;

25           the trim moldings having generally arcuate configurations; and

          an air plenum assembly attached to and extending from an interior surface of the roof assembly.

14. The roof assembly of Claim 13 further comprising:

the air plenum assembly formed in part from a plurality of plenum panels; and

5 a respective hanger assembly attached with each plenum panel and the roof assembly.

15. The roof assembly of Claim 13 further comprising:

10 each plenum panel having a generally elongated, rectangular configuration;

the number of plenum panels used to form the air plenum assembly approximately equal to the length of the roof assembly divided by the width of the respective  
15 plenum panels; and

respective connectors coupling adjacent longitudinal edges of the plenum panels with each other.

16. A composite box structure mounted on a railway car underframe comprising:

a floor assembly mounted on and attached to the railway car underframe;

5 a pair of side wall assemblies and a pair of end wall assemblies attached to the floor assembly and the railway car underframe;

each side wall assembly and each end wall assembly having an exterior surface formed from a plurality of metal sheets;

10 foam insulation bonded with interior surfaces of the metal sheets;

a temperature control unit mounted on one of the end wall assemblies;

15 a roof assembly attached to and coupled with the side wall assemblies and the end wall assemblies opposite from the floor assembly;

the roof assembly having a generally arcuate configuration;

20 an air plenum assembly attached to and extending from an interior surface of the roof assembly;

an interior bulkhead disposed adjacent to and spaced from the one end wall assembly to provide portions of an airflow path to return air from an interior of the composite box structure to the temperature control unit;

25 a first end of the air plenum assembly coupled with a portion of the interior bulkhead to provide portions of an airflow path to supply air from the temperature control unit to the interior of the composite box structure;



a plurality of plenum panels disposed adjacent to each other and respectively attached with the roof assembly;

5 a chute assembly forming a portion of the air supply flow path from the temperature control unit to the air plenum assembly defined in part by a first support disposed on and attached with an upper portion of the interior bulkhead;

10 a transition panel attached with the first support and extending at an angle between the upper portion of the interior bulkhead and the air panel assembly; and

15 a first side panel and a second side panel respectively attached to opposite edges of the transition panel to direct airflow from the temperature control unit to the air plenum assembly.

17. The composite box structure of Claim 16 wherein the floor assembly further comprises a primary floor and  
20 a secondary floor with an airflow path formed between the secondary floor and the primary floor to provide portions of an airflow path for supplying air to the interior of the composite box structure.

25 18. The composite box structure of Claim 16 further comprising an airflow coupling extending between a second end of the air plenum assembly and at least one airflow path disposed on an interior surface of the other end wall assembly.

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19. A roof assembly for a railway car comprising:  
the roof assembly having a generally elongated,  
rectangular configuration;  
5 an air plenum assembly attached to and  
extending from an interior surface of the roof assembly;  
the air plenum assembly operable to receive air  
from a temperature control unit and to provide portions  
of an airflow path from the temperature control unit;  
10 the air plenum assembly formed in part by a  
plurality of plenum panels disposed adjacent to each  
other;  
a first longitudinal edge and a second  
longitudinal edge spaced from each other and extending  
15 from a first lateral edge to a second lateral edge;  
at least a first layer of fiber reinforced  
plastic and at least a second layer of fiber reinforced  
plastic with insulating foam disposed therebetween;  
the longitudinal edges and the lateral edges of  
20 the roof assembly formed in part by bonding respective  
portions of the first layer of fiber reinforced plastic  
with the second layer of fiber reinforced plastic;  
a plurality of stiffeners disposed between the  
first layer of fiber reinforced plastic and the second  
25 layer of fiber reinforced plastic; and  
the stiffeners spaced from each other and  
extending from the first longitudinal edge to the second  
longitudinal edge.

20. A roof assembly for a temperature controlled railway car having a composite box structure mounted on a railway car underframe comprising:

the roof assembly having a generally elongated,  
5 rectangular configuration corresponding approximately with configurations of the composite box structure and the railway car underframe;

the roof assembly having a generally arcuate configuration extending from a first longitudinal edge of  
10 the roof assembly to a second longitudinal edge of the roof assembly;

the roof assembly having a cross section defined in part by a first layer of fiber reinforced plastic and a second layer of fiber reinforced plastic;

15 the first layer and second layer cooperating with each other to encapsulate insulating material therebetween;

the first longitudinal edge and the second longitudinal edge of the roof assembly formed in part  
20 from at least the two layers of fiber reinforce plastic;

a plurality of trim moldings attached to and extending between the roof assembly and adjacent interior portions of the composite box structure;

the trim moldings having generally arcuate  
25 configurations;

an air plenum assembly attached to and extending from an interior surface of the roof assembly formed in part from a plurality of plenum panels;

each plenum panel having a generally elongated,  
30 rectangular configuration;

the number of plenum panels used to form the  
air plenum assembly approximately equal to the length of  
the roof assembly divided by the width of the respective  
plenum panels; and

- 5                    respective connectors coupling adjacent  
longitudinal edges of the plenum panels with each other.